SEALING, TRIMMING OR FINISHING STRIPS

Technical Field

The invention relates to sealing, trimming or finishing strips to be used for carrying out sealing, trimming or finishing functions in motor vehicle bodies.

Disclosure of the Invention

According to the invention, there is provided a sealing, trimming or finishing strip comprising a longitudinally extending sealing part defining a longitudinal hollow interior which becomes partially compressed in use, the hollow interior of the sealing part being provided with means for controlling the compression of the sealing part.

The compression controlling means may provide a "stop" which prevents or substantially reduces any further compression of the sealing part beyond a desired amount. For example, when a vehicle closure member closes an opening in the vehicle body, a peak compression force may be applied to the sealing part during the closing operation (for example, by a user to ensure that the closure member will be securely latched closed – such as when a car door is slammed shut). This peak force is applied only momentarily, and the compression controlling means may limit the amount of compression of the sealing part at this time, whereafter the force applied will be reduced.

Brief Description of the Drawings

Sealing, trimming or finishing strips embodying the invention, for use in carrying out sealing functions in motor vehicle bodies, will now be described, by way of example only, with reference to the accompanying diagrammatic drawings in which:

Figure 1 is a side elevational view of a vehicle to which the sealing, trimming or finishing strips may be fitted;

Figure 2a is a perspective view of part of a first form of sealing, trimming or finishing strip;

Figure 2b is a perspective view of part of a second form of sealing, trimming or finishing strip;

Figure 2c is a perspective view of part of a third form of sealing, trimming or finishing strip;

Figure 2d is a perspective view of part of a fourth form of sealing, trimming or finishing strip;

Figure 3a is a cross-sectional view, along line I-I of Figure 1, of a sealing, trimming or finishing strip carrying out a sealing function in a vehicle body, in which the vehicle door is exerting normal pressure on the sealing, trimming or finishing strip;

Figure 3b is the cross-sectional view of Figure 3a, in which the vehicle door is exerting a slight over-pressure on the sealing, trimming or finishing strip;

Figure 3c is the cross-sectional view of Figure 3a, in which the vehicle door is exerting a greater over-pressure on the sealing, trimming or finishing strip;

Figure 3d is the cross-sectional view of Figure 3a, in which the vehicle door is exerting a substantial over-pressure on the sealing, trimming or finishing strip;

Figure 4 is a graph showing the force applied (F) to the sealing part of the strip in Figures 2 and 3a-3d plotted against the amount of deformation (d) of the sealing part of the strip;

Figure 5 is a cross-sectional view, along line I-I of Figure 1, of an alternative embodiment of a sealing, trimming or finishing strip;

Figure 6a is a cross-sectional view, along line II-II of Figure 1, of an embodiment of a sealing, trimming or finishing strip carrying out a sealing function on the boot of a motor vehicle body;

Figure 6b is a cross-sectional view of an alternative embodiment of a sealing, trimming or finishing strip carrying out a sealing function on the boot of a vehicle body; and

Figure 7 is a perspective view of part of an alternative configuration of a sealing, trimming or finishing strip of Figure 2.

In the figures like elements are generally designated with the same reference numeral.

Modes for Carrying out the Invention

Figure 1 shows a motor vehicle 2. A sealing, trimming or finishing strip as described hereinafter could be provided to the motor vehicle door region or the vehicle boot region to provide a weather-tight seal, or to any other region where a closure member closes an opening in the body of the vehicle 2.

One form of the sealing, trimming or finishing strip 4 is shown in Figure 2a. Such a sealing, trimming or finishing strip 4 could be applied to a motor

vehicle door frame (i.e. the part of the vehicle body against which the door is closed). The strip 4 comprises a sealing part 6 and a mounting part 8.

The mounting part 8 is preferably formed by extrusion, although it could be formed by moulding or any other suitable technique.

The mounting part 8 is in the form of a longitudinal channel 10 having a base 60 from which opposite, generally parallel side walls 62,64 extend. In use, the mounting part 8 is embracingly clamped to the frame surrounding the motor vehicle door opening in the body. More specifically, the frame surrounding of the door opening normally comprises a flange where the inner and outer body panels are welded together.

The mounting portion 8 comprises a reinforcing core or carrier 12 such as made of resilient metal or other resilient and relatively rigid material, which is embedded in the flexible material 14 of the mounting part 8, such as rubber or plastics material – for example TPE or EPDM. For example, the carrier 12 may be made of metal and in the form of (inverted) U-shaped elements arranged side-by-side to define the channel 10 and connected together by integral short connecting links or disconnected from each other. Other forms of carrier are, of course, possible. The carrier may be made of wire looped to and fro, and may be incorporated in the material 14 using a cross-head extruder.

The carrier need not be made of metal, for example a flexible but substantially non-extensible tape may be incorporated into the material 14.

The material 14 is formed to define integral gripping lips 16 and 18 positioned on the opposite inside facing walls 62,64 of the channel 10. The lips 16, 18 make contact with the opposite faces of the flange and increase the frictional gripping of the mounting part 8. Advantageously, the material of the lips 16, 18 is arranged to be softer than the remainder of the extruded material 14 to increase the frictional grip of the lips 16, 18 against the flange.

The sealing part 6 is of generally hollow tubular form and may be co-extruded with the mounting part 8. However, it is not necessary for the sealing part 6 to be co-extruded with the mounting part 8. Instead, the sealing part 6 may be made separately, by extrusion or moulding (or other suitable method) from appropriate material(s), and may then be secured to the mounting part 8 by adhesive, moulding, welding or any other suitable technique.

The sealing part 6 extends from wall 64 of the mounting part 8.

The extruded material 20 of the sealing part 6 may be foamed or cellular material. Such material is more readily compressible than the non-foamed or solid material of the mounting part 8. The foamed or cellular material 20 may enhance sealing and allow the sealing part 6 to provide effective sealing even

when there are irregularities or discontinuities in the surface which the sealing part 6 abuts or in the flange on which the mounting part is mounted. Of course, it should be appreciated that the extruded material 20 may be partly or wholly formed of non-foamed or solid material, although such material will preferably be more easily compressible than the material 14 of the mounting part 8.

In this example, the extruded material 20 of the sealing part 6 comprises an interior wall 22 defining within the void of the sealing part 6 a first longitudinally extending hollow 24 and a second longitudinally extending hollow 26. The sealing part 6 thus comprises a hollow interior made up of first and second longitudinally extending hollows 24, 26 which are separated by the interior wall 22 formed from the extruded material 20. The interior wall 22 has a portion 27 of bulbous cross-section and an inherent resilience, enabling the interior wall to act as a "stopper" when excessive pressure is exerted on the sealing part 6, in a manner to be described hereinafter. The wall 22 and bulbous portion 27 are formed from the same material (having the same hardness) as the rest of the extruded material 20.

Second, third and fourth forms of the sealing, trimming or finishing strip 4 are shown in Figures 2b, 2c and 2d respectively. These alternative forms are substantially of the form of the sealing, trimming or finishing strip described above with reference to Figure 2a, except for the form of the interior wall 22

defining within the void of the sealing part 6 the first longitudinally extending hollow 24 and the second longitudinally extending hollow 26.

In the second form of the sealing, trimming or finishing strip 4, shown in Figure 2b, the interior wall 22 is not formed of material having the same properties as the material 20 of the sealing part 6. The material 29 of the interior wall 22 may in this case be harder or softer than the material 20 of the interior wall of the first form of sealing, trimming or finishing strip 4. In this case, the interior 22 may be co-extruded with the sealing part 6 or may be made separately, by extrusion or moulding (or other suitable method) from appropriate material(s), and then secured to the sealing part 6 by adhesive, moulding, welding or any other suitable technique.

In the third form of the sealing, trimming or finishing strip 4, shown in Figure 2c, the interior wall 22 is again not formed of material having the same properties as the material 20 as the sealing part 6. In this form, the interior wall 22 comprises two portions 31, 33 which are harder than the material 20 of the interior wall of the first form of sealing, trimming or finishing strip 4. In the embodiment shown in Figure 2c, the first portion 31 (which comprises the part of the bulbous cross-section portion 27 facing the first longitudinally extending hollow 24) is harder than the second portion 33 (which comprises the part of the bulbous cross-section portion 27 facing the second longitudinally extending hollow 26 and the portion of the interior wall 22 which joins the sealing part 6),

thereby further enhancing the resilience of the bulbous cross-section portion 27 and its ability to act as a "stopper" when excessive pressure is exerted on the sealing part 6. Again, the interior wall 22 may be co-extruded with the sealing part 6 or may be made separately, by extrusion or moulding (or other suitable method) from appropriate material(s), and then secured to the sealing part 6 by adhesive, moulding, welding or any other suitable technique. Further, the first and second materials 31, 33 comprising the interior wall 22 may be co-extruded or may be made separately and then secured together using a suitable technique. The first portion 31 may be softer than the second portion 33.

In the fourth form of the sealing, trimming or finishing strip 4, shown in Figure 2d, the interior wall 22 is formed of the same material 20 (having the same hardness) as the sealing part 6. In this form, the bulbous cross-section portion 27 comprises a plurality of spaced apart protrusions or ridges 35 on the surfaces facing the first and second longitudinally extending hollows 24, 26. The protrusions 35 extend longitudinally along the length of the interior wall 22. The protrusions 35 may reduce the noise generated when the closure member is closed. The protrusions 35 may also reduce the tendency for the bulb 27 to stick to the outer internal surface 36 and/or the inner internal surface 38 of the sealing part 6 when the closure member remains closed for an extended period of time. The protrusions may act to control the outer internal surface 36 and inner internal surface 38 of the sealing part 6 as the motor vehicle door 28 is closed (which will be described hereinafter with reference to Figures 3a, 3b, 3c

and 3d), thereby enhancing the ability of the bulbous cross-section portion 27 to act as a "stopper" when excessive pressure is exerted on the sealing part 6.

In use, the mounting part 8 mounts the sealing, trimming or finishing strip on the motor vehicle door frame, so that the sealing part 6 extends around the motor vehicle door opening, on the outside of the motor vehicle body. The closing door thus partially compresses the sealing part 6 which thereby provides a weather-tight seal.

Figures 3a, 3b, 3c and 3d show cross-sectional views of the sealing, trimming or finishing strip of Figure 2 along the line I-I of Figure 1 in increasing states of compression as the motor vehicle door 28 is closed. In these examples, the mounting part 8 is mounted to the frame of the door opening defined by an inner body panel 30 and an outer body panel 32 at the point where the inner and outer body panels 30, 32 are welded together to form a flange 34.

Figure 3a defines the normal working condition, wherein the motor vehicle door 28 is exerting a normal pressure or force F_1, on the sealing part 6 of the sealing, trimming or finishing strip. The normal working condition is the condition when the door 28 is closed with no additional pressure being exerted on the door 28. In this condition, the sealing part 6 is slightly deformed and resiliently presses against the door 28 prevent the ingress of moisture and dirt and to minimise wind noise within the vehicle cabin.

Figure 3b shows the situation where the door 28 is exerting a slight over-pressure or force F_2 on the sealing part 6 of the sealing, trimming or finishing strip. The force F_2 increases the deformation of the sealing part 6 which leads to a reduction of the distance between the outer surface 36 of the sealing part 6 and the interior wall 22 defining the first longitudinally extending hollow 24. In Figure 3b, the outer internal surface 36 of the sealing part 6 and the interior wall 22 are in fact in contact. However, the force F_2 is not substantial enough to cause deformation of the interior wall 22.

Figure 3c shows the situation where the door 28 is exerting a greater over-pressure or force F_3 on the sealing part 6. The force F_3 is in excess of the force F_2. The force F_3 causes deformation of the sealing part 6 to such an extent that the interior wall 22 is also deformed and the distance between the interior wall 22 and the inner internal surface 38 of the sealing part 6 defining the second longitudinally extending hollow 26 is also reduced. In Figure 3c, the interior wall 22 and the inner surface 38 of the sealing part 6 are in contact.

Figure 3d shows the situation where the door 28 is exerting a substantial over-pressure or force F_4 on the sealing part 6. The force F_4 is in excess of the force F_3. The force F_4 causes further deformation of the sealing part 6. However due to the bulbous cross-section portion 27 and inherent resilience of the interior

wall 22, the interior wall 22 acts as a stopper to inhibit any further deformation of the sealing part 6 occurring.

Figures 3a, 3b, 3c and 3d show respective distances d_0, d_1, d_2, d_3 and d_4 measured between the outer internal surface 36 and the inner internal surface 38 of the sealing part 6 at various stages of compression. Figure 4 is a graph showing the force applied (F) to the sealing part 6 of the strip in Figures 3a, 3b, 3c and 3d plotted against the reduction in distance (d) between the surfaces 36 and 38. For example, from this graph it can be seen that a relatively large force is required to cause a relatively small reduction in the distance between the walls 36 and 38 as the door 28 moves from the position shown in Figure 3c to the position shown in Figure 3d. This increase in force/decrease in distance reduction is due to this last phase of movement of the door requiring compression of the bulbous portion 27 itself. The bulbous portion can be seen to be acting as a "stopper" which controls in normal use the minimum distance allowed between the door 28 and the flange 34.

Figure 5 shows an alternative embodiment of a sealing, trimming or finishing strip in cross-section, along the line I-I of Figure 1. In this embodiment the sealing part 6 is not provided with the mounting part 8 for mounting the door on a door frame flange. Instead, the sealing part 6 is secured to the motor vehicle door 28 by adhesive 40, and the outer surface 36 of the sealing part 6 contacts the motor vehicle door frame 42 to perform the sealing function. The

adhesive 14 may be double sided adhesive tape. The sealing part 6 may alternatively be secured to the door 28 by any other suitable means. For example, a flange could be provided on the door which engages the seal (or a mounting part provided on the seal), or a series of studs and correspondingly configured apertures could be provided in the sealing part 6 and the door 28, respectively, to allow those parts to be secured together.

The pressure is exerted on the sealing part 6 by the motor vehicle door frame 42. Deformation of the sealing part 6 occurs as a consequence of the pressure applied to the door 28 in the same manner as described hereinbefore in relation to Figures 3a to 3d. Again, the interior wall 22 acts as a stopper when substantial pressure is applied to the door 28 due to the bulbous cross-section portion 27 and inherent resilience of the interior wall 22.

Figures 6a and 6b show cross-sectional views of sealing, trimming or finishing strips, along the line II-II of Figure 1, where the sealing, trimming or finishing strips are carrying out a sealing function on the boot 46 of a motor vehicle.

In Figure 6a, the frame 44 of the opening in the vehicle body has a generally U-shaped cross-section and terminates in a flange 45. The flange 45 extends generally perpendicularly to the abutment surface of the boot 46. The sealing part 6 of a sealing, trimming or finishing strip 4A is mounted on the flange 45.

The strip defines an inverted U-shaped channel 10A defining a mounting part 8A. The mounting part 8A has a similar form and performs a similar function to the mounting part 8 of described above for mounting on the flange 34 of a door frame. However the sealing part 6A is extends from the base 60 of the channel 10. The sealing part 6A comprises an interior wall 22 having a bulbous cross-section portion 27.

The sealing part 6A is compressed in response to varying applied pressure, in a similar manner as described above in relation to the sealing part 6, as the boot 46 is closed against the frame 44 in the direction of arrow X.

In Figure 6b, the frame 44A is generally L-shaped and terminates in a flange 45A.

The flange 45A extends generally parallel to the abutment surface of the boot 46. In this embodiment, the sealing portion 6B extends from the wall 64 of the mounting portion 8 to seal against the abutment surface of the boot 46. The sealing part 6B is provided with additional abutment lips 70,72 which abut against the surface of the frame 44A which extends perpendicularly to the flange 45A to help locate the sealing part 6B.

In both Figures 6a and 6b the bulbous portion 27 of interior wall 22 acts as a stopper when substantial pressure is applied to the boot 46 due to the bulbous

cross-section and inherent resilience of the bulbous portion 27 of the interior wall 22.

Figure 7 shows an alternative configuration of a sealing, trimming or finishing strip. In this configuration, the materials 14 and 20 of the mounting part 8 and sealing part 6 are formed to define a so-called "cosmetic lip" 48. Such a cosmetic lip 48 is used to cover over, and to help secure, the edge of a trim panel or the like inside the vehicle body. The cosmetic lip 48 is preferably co-extruded with the sealing part 6 and the mounting part 8.

The mounting part 8 and the sealing part 6 may also be provided with a covering layer 50. Such a covering layer may be a fabric layer. The covering layer 50 may provide the strip with a desired appearance (such as a particular colour). The covering layer 50 is advantageously provided to any of the embodiments described herein where the sealing part 6 is formed of foamed or cellular material, the covering layer 50 being a non-foamed or solid material.

In use, the mounting part 8 mounts the sealing part 6 around the frame of an aperture, so that the sealing part 6 extends around an opening (a door opening or a boot opening), on the outside of the vehicle body. The closing door or boot thus partially compresses the sealing portion 6 which thereby provides a weather-tight seal. When mounted in this way, the mouth of the channel 10 will of course face away from the centre of the door or boot opening.

In order to provide good sealing, it is desirable that the material 20 of the sealing part 6 should be very soft and flexible. In this way, it can provide effective sealing even if there are discontinuities or variations in the thickness of the flange and/or the abutment surface of the door or boot. Soft material is also advantageous because it may be of foamed or cellular form, and therefore light in weight. However, it is necessary for the strip 4 to be bent to follow curves or corners in the door or boot frame. When bent in this way, there will be a tendency for the sealing part 6 to become wrinkled at the curves or corners as the strip 4 is bent to follow the curves or corners. The mouth of the channel 10 will be on the outside of the bend. The softer the material of the sealing part 6, the greater the tendency for this to wrinkle at the curves or corners will be. The interior wall 22 may act as a reinforcement to the sealing part 6, and may increase the stiffness of the sealing part 6 in the directions of arrows D (Figure 2) without reducing the effective softness in the direction of arrows E. The increased stiffness in the direction of arrows D reduces or substantially eliminates any tendency of the sealing part 6 to wrinkle at, or "bridge across", bends or curves in the mounting flange. In this way, therefore, it is possible for the sealing portion 6 to be made of substantially softer material because the increased tendency of such very soft material to wrinkle at or bridge across bends or corners is substantially eliminated by the presence of the interior wall 22.

The interior wall 22 may be formed of the same material 20, with the same hardness, as the remainder of the sealing part 6. Alternatively, the interior wall 22 may be formed of material which is harder than the remainder of the sealing part 6. In an alternative arrangement, the sealing part may be provided with a reinforcement (not shown) which is incorporated within the wall 22. The reinforcement may comprise a length of looped wire of generally zig-zag configuration, or could instead be a thin metal sheet. Other forms of reinforcement are possible. Such a reinforcement could be incorporated into the wall 22 by co-extrusion during the extrusion process forming the sealing part 6. For example, reinforcements of the type described in our United Kingdom patent GB 2327451 (the content of which is fully incorporated herein by reference) may be provided in the interior wall 22 described herein.

As an alternative to the bulbous portion 27 being integrally formed with the wall 22, the bulbous portion could be formed integrally with one of the side walls 36,38 of the sealing part – forming a protrusion therefrom. In this embodiment there would only be a single hollow or void within the sealing part.